

BACKGROUND OF THE INVENTION

This invention relates to moisture detectors, and more particularly to water leak detectors and alarms. Prior water leak alarms have been either bulky, complicated, difficult to instal or relatively expensive.

OBJECTIVES OF THE INVENTION

Accordingly, it is an object of this invention to provide a combined water leak detector and audible alarm that is roughly the size of a credit card.

Another object is to provide a water leak alarm that is always on so that activation by the user is not required.

An additional object is to provide a unitary moisture detector and alarm that can be used to display messages or promote or advertise business services or other products.

Another object is to provide water leak detectors and alarms that can be placed almost anywhere without requiring preparation of the location where they are placed.

A further object is to provide a water leak detector that can be tested with a person's wet finger.

An additional object is to provide a corrosion proof and environmentally safe leak detector that has gold plated conductors.

Another object is to provide a water leak alarm that is high pitched so that it will not be mistaken for a smoke alarm.

A further object is to provide small, portable, self-contained water leak detector and alarm promotional cards that are durable, economical, highly attractive, easy to use and maintain, and which do not possess defects found in similar prior art leak detection devices.

Other objects and advantages of the moisture alarms incorporating this invention will be found in the specification and claims and the scope of the invention will be set forth in the claims.

DESCRIPTION OF THE DRAWING

Fig. 1 is a schematic side view of an embodiment of a detector in accord with this invention.

Fig. 2 is a top plan view of the Fig. 1 detector.

Fig. 3 is a bottom plan view of the Fig. 1 detector.

Fig. 4 is an enlarged cross sectional view taken along the line 4-4 in Fig. 2.

Fig. 5 is an exploded view showing the parts of the Fig. 1 detector.

Fig. 6 is an enlarged, schematic, partially cross sectional, fragmentary view of a first rivet in a hole through the detector.

Fig. 7 is an enlarged, schematic, partially cross sectional, fragmentary view of a second rivet in a hole through the detector.

Fig. 8 is a schematic circuit diagram.

DESCRIPTION OF THE INVENTION

The drawing shows an integral moisture detector, audible alarm and message display card 1. In Fig. 1 the card 1 has been placed on a horizontal surface 2, such as the floor on the inside of a kitchen or bathroom cabinet, that would become wet if plumbing thereabove, such as the kitchen or bathroom sink drain trap 3, were to leak. Other locations where the card 1 could be placed on or near to detect a leak and sound an alarm include fish tanks, bottled water dispensers, refrigerators, dish washers, window sills, hot water heaters, washing machines, toilets, infant baths, flower pots and waterbeds. The card 1 can be placed on top of a sheet 4 of paper towel or napkin to expand the area in which the card will come into contact with moisture. The card 1 can also be placed on any of its sides or edges or hung vertically.

The base of card 1 may be a thin, rigid, moisture proof solid board 7 may be made from non-electrical conducting plastic such as PCB-FR-4 material. The board 7 has a first or upper flat surface 10, and an opposite or lower flat surface 11. The upper and lower surfaces 10 and 11 have end edges 15 around the entire periphery of board 7. A hole 12 through the board 7 may be used to nail or screw the card 1 to any supporting surface, or, with a string or twist tie, to suspend the card 1 in air.

A first water leak or moisture detection conductor strip 16 has been imprinted on the upper surface 10 around the entire periphery of the card. A second water leak or moisture detection conductor strip 17 has also been imprinted on the upper surface 10. The second strip 17 is located within and is completely circumscribed by the first strip 16. The second strip 17 is spaced inwardly away from the first strip 16 in the direction away from the peripheral end edges 15 a distance 5 sufficient to electrically insulate the strips 16 and 17 from each other.

A third water leak or moisture detection conductor strip 18 has been imprinted on the lower surface 11 around the entire periphery of the board 7. A fourth water leak or moisture detection conductor 19 has also been imprinted on the lower surface 11. The fourth strip 19 is located within and is completely circumscribed by the strip 18. The fourth strip 19 is spaced inwardly away from the third strip 18 in the direction away from the peripheral edges 15 a distance 6 sufficient to electrically insulate the strips 18 and 19 from each other.

Metal fasteners such as a pair of aluminum rivets 20 and 21 may be used to attach a circular plastic housing 22 to the upper surface 10 of board 7. The housing 22 has an inner bottom cylindrical cup 23 and a removable outer upper cylindrical cap 24. As shown in Fig. 6, rivet 20 extends through a first circular hole 25 that

passes through third strip 18 and the board 7 and first strip 16. As shown in Fig. 7, the rivet 21 extends through a second circular hole 26 that passes through fourth strip 19 and the board 7 and second strip 17. The bottom head 27 of the rivet 20 contacts the third strip 18 and the top head 28 of the rivet 20 extends into the cup 23. The bottom head 29 of rivet 21 contacts the fourth strip 19 and the top head 30 of the rivet 21 extends into the cup 23. The top head 28 of rivet 20 and the top head 30 of rivet 21 hold the cup 23 on the board 7. Rivets 20 and 21 also act as current conductors in the leak detection circuit.

The water leak and moisture detection conductor strips 16-19 may be made from copper that is deposited in rectangular configurations or stripes directly on the upper and lower surfaces of the board 7. The holes 25 and 26 are both completely coated with the same copper that is deposited on board 7 to form the strips 16-19. The copper coating 31 in first hole 25 merges into the copper from which both the strips 16 and 18 are made so that the copper coating hole 25 provides a first metallic connector that extends through the board 7 and makes a direct electrical conducting path between the strips 16 and 18. The copper coating 32 in second hole 26 merges into the copper from which both the strips 17 and 19 are made so that the copper coating hole 26 defines a second metallic connector that extends through board 7 and makes a direct electrical conducting path between the strips 17 and 19. The exposed copper surfaces of strips 16-19 and the holes 25 and 26 may be completely coated with gold plating.

Housing 22 contains the components of an electric circuit that detects moisture and sends an audible signal when a water leak occurs. The strips 16-19 are connected to the opposite polarity terminals 40 and 41 of the circuit shown in Fig. 8. One end of a coated conductor wire 42 is attached to the top head 28 of rivet 20

and the other end of wire 42 is attached to terminal 40. This connects the strips 16 and 18 to the positive side of a 1.5 volt DC battery 43. One end of a coated conductor wire 44 is attached to the top head 30 of rivet 21 and the other end of wire 44 is attached to terminal 41. This connects strips 17 and 19 to the negative side of the battery through sound chip 49, such as an EP-03 Sound Effect Module by Touch from Safe Treasure Enterprise Co., Ltd. A capacitor 45 (0.1uf) may bridge the conductors connecting the negative side of battery 43 and the sound chip 49. The sound chip is connected by coated conductor wires 46 and 47 to a small speaker 48. Water bridging the space between strips 16 and 17 or the space between strips 18 and 19 completes the circuit so that current flows to the sound chip and causes speaker 48 to emit an audible warning signal revealing a leak. The pitch of the audible signal may be sufficiently high that the signal will not be confused with that of a smoke alarm.

The terminals 40 and 41, the capacitor 45 and the sound chip 49 may be held on a printed circuit board 50 that has the conductors 51 for these components and for the battery 43 printed thereon. The battery 43 may be removably held in a conducting sleeve 52 attached to the board 50. A post 53 that extends upwardly from the inside of cup 24 holds the board 50 above the top heads 28 and 30 of the rivets 20 and 21. A pad 54 of insulating plastic foam may be placed between the bottom of speaker 48 and the components on board 50. The cap 24 has a large center hole 55, and the top of speaker 48 extends through the hole 55 above the housing.

The card 1 is also usable to visually display written messages, advertisements and other visible promotional matter, such as business logos, telephone numbers and street and internet addresses. A flat, smooth unobstructed area 60 on the upper

surface 10 of board 7 is surrounded by the inner edges of the strip 17. A flat, smooth unobstructed area 61 on the upper lower 11 of board 7 is surrounded by the inner edges of the strip 19. The areas 60 and 61 are capable of having written messages 62 printed directly thereon. Written messages can also be printed on adhesive backed decals or labels 63 which can be affixed to either area 60 or 61.

While the present invention has been described with reference to particular embodiments, it is not intended to illustrate or describe all of the equivalent forms or ramifications thereof. Also, the words used are words of description rather than limitation, and various changes may be made without departing from the spirit or scope of the invention disclosed herein. It is intended that the appended claims cover all such changes as fall within the true spirit and scope of the invention.